2. Subbasin Assessment – Water Quality Concerns and Status

In 1998, DEQ established a new 303(d) list based on 1993-1996 assessments performed Through the Beneficial Use Reconnaissance Program (BURP) and other pertinent material regarding beneficial use status and water quality standards violations. Waters monitored through BURP after 1996 have not been assessed for 303(d) listing purposes. The 1998 303(d) list included five (5) stream segments (six assessment units) in the Beaver-Camas Subbasin (Table 11 and Figure 30). The EPA approved that list in May 2000.

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

There are six water quality limited assessment units (AU) in the Beaver-Camas Subbasin, and of the six, only the upper halves of two of the listed segments are perennial; Camas Creek, Spring Creek to Highway 91 and Beaver Creek, Spencer to Dubois. The remaining listed segments are either ephemeral or intermittent streams that do not sustain flows all year long.

Figure 31 shows the 303(d) listed water quality segments in the Beaver-Camas Subbasin. Table 11 summarizes the 303(d) listed waterbody, its boundaries, assessment units, water quality limited segment number, and listing basis.

Section 303(d) of the CWA states that waters that are unable to support their beneficial uses and that do not meet water quality standards must be listed as water quality limited waters. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

<u>About Assessment Units</u>

AUs now define all the waters of the state of Idaho. These units and the methodology used to describe them can be found in the Water Body Assessment Guidance (WBAG), second edition (Grafe et al 2002).

Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management. Stream order, however, is the main basis for determining AUs—although ownership and land use can change significantly, the AU remains the same.

Using assessment units to describe water bodies offers many benefits, the primary benefit being that all the waters of the state are now defined consistently. In addition, using AUs fulfills the fundamental requirement of EPA's 305(b) report, a component of the Clean Water Act wherein states report on the condition of all the waters of the state. Because AUs are a subset of water body identification numbers, there is now a direct tie to the water quality standards for each AU, so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

However, the new framework of using AUs for reporting and communicating needs to be reconciled with the legacy of 303 (d) listed streams. Due to the nature of the court-ordered 1994 303(d) listings, and the subsequent 1998 303(d) list, all segments were added with boundaries from "headwater to mouth." In order to deal with the vague boundaries in the listings, and to complete TMDLs at a reasonable pace, DEQ set about writing TMDLs at the watershed scale (HUC), so that all the waters in the drainage are and have been considered for TMDL purposes since 1994.

The boundaries from the 1998 303(d) listed segments have been transferred to the new AU framework, using an approach quite similar to how DEQ has been writing SBAs and TMDLs. All AUs contained in the listed segment were carried forward to the 2002 303(d) listings in Section 5 of the Integrated Report. AUs not wholly contained within a previously listed segment, but partially contained (even minimally), were also included on the 303(d) list. This was necessary to maintain the integrity of the 1998 303(d) list and to maintain continuity with the TMDL program. These new AUs will lead to better assessment of water quality listing and de-listing.

When assessing new data that indicate full support, only the AU that the monitoring data represents will be removed (de-listed) from the 303(d) list (Section 5 of the Integrated Report.).

Listed Waters

Table 11 shows the pollutants listed and the basis for listing for each §303(d) listed AU in the subbasin. Not all of the water bodies will require a TMDL, as will be discussed later. However, a thorough investigation, using the available data, was performed before this conclusion was made. This investigation, along with a presentation of the evidence of non-compliance with standards for several other tributaries, is contained in the following sections.

Table 11. §303(d) Segments in the Beaver-Camas Subbasin.

Waterbody Name	WQL SEG	AU of HUC 17040214	1998 §303(d)[1] Boundaries	Pollutants	Listing Basis
Camas Creek	2190	SK001_06	Hwy 91 to Mud Lake	Flow alteration, nutrients, sediment	1996 Carry-0ver
Camas Creek	2191	SK002_05	Spring Creek to Hwy 91	Flow alteration, habitat alteration, nutrients, sediment, and temperature	1996 Carry-over
Beaver Creek	2193	SK003_05 SK014_05	Dubois to Camas Creek	Flow alteration, habitat alteration, nutrients, sediment, and temperature	1996 Carry-over
Beaver Creek	2194	SK015_05	Spencer to Dubois	Flow alteration, habitat alteration, nutrients, sediment, and temperature	1996 Carry-over
Cow Creek	5233	SK018_04	Headwaters to Thunder Gulch	Unknown	Low metric scores

[1]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

2.2 Applicable Water Quality Standards

Water Quality standards are legally enforceable rules and consist of three parts: the designated uses of waters, the numeric or narrative criteria to protect those uses, and an antidegradation policy. Water quality criteria used to protect these beneficial uses include narrative “free from” criteria applicable to all waters (IDAPA 58.01.02.200), and numerical criteria, which vary according to beneficial uses (IDAPA 58.01.02.210, 250, 251, & 252). Typical numeric criteria include bacteriological criteria for recreational uses, physical and chemical criteria for aquatic life [e.g. pH, temperature, dissolved oxygen (DO), ammonia, toxics, etc.], and toxics and turbidity criteria for water supplies. Idaho’s water quality standards are published in the State’s rules at *IDAPA 58.01.02 Water Quality Standards and Wastewater Treatment Requirements*. Designated beneficial uses for waters in the Beaver-Camas Subbasin are listed in Table 12.

Beneficial Uses

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as briefly described in the following paragraphs. The *Water Body Assessment Guidance*, second edition (Grafe et al. 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

Existing Uses

Existing uses under the CWA are “those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards.” The existing in-stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.050.02, .02.051.01, and .02.053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a waterbody that could support salmonid spawning, but salmonid spawning is not occurring due to other factors, such as dams blocking migration.

Designated Uses

Designated uses under the CWA are “those uses specified in water quality standards for each water body or segment, whether or not they are being attained.” Designated uses are simply uses officially recognized by the state. In Idaho these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use, such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.27 and .02.109-.02.160 in addition to citations for existing uses).

Presumed Uses

In Idaho, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called "presumed uses," DEQ will apply the numeric cold water criteria and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, an additional existing use, (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for salmonid spawning would additionally apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, cold water aquatic life is not found to be an existing use, an use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

Tables 12 and 13 show the beneficial use status of streams in the Beaver-Camas Subbasin. Use designations are assigned to several sections of Beaver and Camas Creeks, many of which are 303(d) listed segments (Table 12).

Existing and presumed uses for streams in the subbasin are listed in Table 13. As mentioned above, the undesignated streams in the watershed are presumed to support CWAL and PCR or SCR. Where data is available, known existing or potential existing uses are identified. Water quality data, particularly fish count data, show that SS has or is supported in all of the remaining streams in the subbasin so, SS is considered an existing use for all of the undesignated streams in the watershed.

Table 12. Beaver-Camas Subbasin designated beneficial uses.

Waterbody	Waterbody Unit (WBID)	Boundaries	Designated Uses[1]	1998 §303(d) List[2]
Camas Creek	1	Beaver Creek to Mud Lake	CWAL, SS, PCR	Yes
Camas Creek	2	Spring Creek to Beaver Creek	CWAL, SS, PCR	Yes
Beaver Creek	3	Canal (T09N, R36E) to mouth	CWAL, SS, PCR, DWS	No
Camas Creek	7	Confluence of West and East Camas Creeks to Spring Creek	CWAL, SS, PCR	No
Beaver Creek	14	Dry Creek to Canal (T09N, R36E)	CWAL, SS, PCR, DWS	Yes
Beaver Creek	15	Rattlesnake Creek to Dry Creek	CWAL, SS, PCR, DWS	Yes
Beaver Creek	18	Miners Creek to Rattlesnake Creek	CWAL, SS, PCR, DWS	Yes
Beaver Creek	20	Idaho Creek to Miners Creek	CWAL, SS, PCR, DWS	Yes
Beaver Creek	21	Source to Idaho Creek	CWAL, SS, PCR, DWS	No

[1]CWAL – Cold Water Aquatic Life, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, AWS – Agricultural Water Supply, DWS – Domestic Water Supply

[2]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

Table 13. Beaver-Camas Subbasin presumed/existing beneficial uses

Waterbody	Waterbody Unit (WBID)	Boundaries	Presumed/Existing Uses[1]	1998 §303(d) List[2]
Spring Creek	4	Dry Creek to Mouth	CWAL and PCR or SCR/SS	No
Dry Creek	25	Source to Mouth	CWAL and PCR or SCR/SS	No
Ching Creek	6	Source to Mouth	CWAL and PCR or SCR/SS	No
Crooked/Crab Creek	8	Source to Mouth	CWAL and PCR or SCR/SS	No
Warm Creek	9	Cottonwood Creek to mouth and East Camas Creek – T13N, R39E, Sec 20, 6400 ft. elevation to Camas Creek	CWAL and PCR or SCR/SS	No
East Camas Creek	10	From and including Larkspur Creek to T13N, R39E, Sec. 20, 6400 ft elevation	CWAL and PCR or SCR/SS	No
East Camas Creek	11	Source to Larkspur Creek	CWAL and PCR or SCR/SS	No
West Camas Creek	12	Targhee National Forest Boundary (T13N, R38E) to Camas Creek	CWAL and PCR or SCR/SS	No
West Camas Creek	13	Source to Targhee National Forest Boundary (T13N, R38E)	CWAL and PCR or SCR/SS	No
Rattlesnake Creek	16	Source to Mouth	CWAL and PCR or SCR/SS	No
Threemile Creek	17	Source to Mouth	CWAL and PCR or SCR/SS	No
Miners Creek	19	Source to Mouth	CWAL and PCR or SCR/SS	No
Idaho Creek	16	Source to Mouth	CWAL and PCR or SCR/SS	No
Pleasant Valley Creek	23	Source to Mouth	CWAL and PCR or SCR/SS	No
Huntley Canyon Creek	24	Source to Mouth	CWAL and PCR or SCR/SS	No
Dry Creek	25	Source to Mouth	CWAL and PCR or SCR/SS	No
Cottonwood Creek Complex	26	Complex	CWAL and PCR or SCR/SS	No

[1]CW – Cold Water, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, AWS – Agricultural Water Supply, DWS – Domestic Water Supply
[2]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of criteria, which include *narrative* criteria for pollutants such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250) (Table 14).

Excess sediment is described by narrative criteria (IDAPA 58.01.02.200.08): “Sediment shall not exceed quantities specified in Sections 250 and 252 or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350.”

Narrative criteria for excess nutrients are described in IDAPA 58.01.02.200.06, which states: “Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.”
Narrative criteria for floating, suspended, or submerged matter are described in IDAPA 58.01.02.200.05, which states: “Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses. This matter does not include suspended sediment produced as a result of nonpoint source activities.”

DEQ’s procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.053. The procedure relies heavily upon biological parameters and is presented in detail in the Water Body Assessment Guidance (Grafe et al. 2002). This guidance requires the use of the most complete data available to make beneficial use support status determinations.

Table 14 includes the most common numeric criteria used in TMDLs.

Figure 32 provides an outline of the stream assessment process for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

Table 14. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Designated and Existing Beneficial Uses				
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation Periods for Inhabiting Species)**
Water Quality Standards: IDAPA 58.01.02.250				
Bacteria, ph, and Dissolved Oxygen	Less than 126 *E. coli*/100 ml[a] as a geometric mean of five samples over 30 days; no sample greater than 406 *E. coli* organisms/100 ml	Less than 126 *E. coli*/100 ml as a geometric mean of five samples over 30 days; no sample greater than 576 *E. coli*/100 ml	pH between 6.5 and 9.0 DO[b] exceeds 6.0 mg/L[c]	pH between 6.5 and 9.5 Water Column DO: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater Intergravel DO: DO exceeds 5.0 mg/L for a one day minimum and exceeds 6.0 mg/L for a seven day average
Tempera-ture[d]			22 °C or less daily maximum; 19 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average Bull trout: not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June – August; not to exceed 9 °C daily average in September and October
			Seasonal Cold Water: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	
Turbidity			Turbidity shall not exceed background by more than 50 NTU[e] instantaneously or more than 25 NTU for more than 10 consecutive days.	
Ammonia			Ammonia not to exceed calculated concentration based on pH and temperature.	

Designated and Existing Beneficial Uses				
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation Periods for Inhabiting Species)**
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131				
Tempera-ture				7 day moving average of 10 °C or less maximum daily temperature for June - September

[a] *Escherichia coli* per 100 milliliters
[b] dissolved oxygen
[c] milligrams per liter
[d] Temperature Exemption - Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the seven-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.
[e] Nephelometric turbidity units

2.3 Pollutant/Beneficial Use Support Status Relationships

Most of the pollutants that impair beneficial uses in streams are naturally occurring stream characteristics that have been altered by humans. That is, streams naturally have sediment, nutrients, and the like, but when anthropogenic sources cause these to reach unnatural levels, they are considered "pollutants" and can impair the beneficial uses of a stream.

Temperature

Temperature is a water quality factor integral to the life cycle of fish and other aquatic species. Different temperature regimes also result in different aquatic community compositions. Water temperature dictates whether a warm, cool, or coldwater aquatic community is present. Many factors, natural and anthropogenic, affect stream temperatures. Natural factors include altitude, aspect, climate, weather, riparian vegetation (shade), and channel morphology (width and depth). Human influenced factors include heated discharges (such as those from point sources), riparian alteration, channel alteration, and flow alteration.

Elevated steam temperatures can be harmful to fish at all life stages, especially if they occur in combination with other habitat limitations such as low dissolved oxygen or poor food supply. Acceptable temperature ranges vary for different species of fish, with cold water species being the least tolerant of high water temperatures. Temperature as a chronic stressor to adult fish can result in reduced body weight, reduced oxygen exchange, increased susceptibility to disease, and reduced reproductive capacity. Acutely high temperatures can result in death if they persist for an extended length of time. Juvenile fish are even more sensitive to temperature variations than adult fish, and can experience negative impacts at a lower threshold value than the adults, manifesting in retarded growth rates. High temperatures also affect embryonic development of fish before they even emerge from the substrate. Similar kinds of affects may occur to aquatic invertebrates, amphibians and mollusks, although less is known about them.

Sediment

Both suspended (floating in the water column) and bedload (moves along the stream bottom) sediment can have negative effects on aquatic life communities. Many fish species can tolerate elevated suspended sediment levels for short periods of time, such as during natural spring runoff, but longer durations of exposure are detrimental. Elevated suspended sediment levels can interfere with feeding behavior (difficulty finding food due to visual impairment), damage gills, reduce growth rates, and in extreme cases eventually lead to death. Newcombe and Jensen (1996) reported the effects of suspended sediment on fish, summarizing 80 published reports on streams and estuaries. For rainbow trout, physiological stress, which includes reduced feeding rate, is evident at suspended sediment concentrations of 50 to 100 mg/L when those concentrations are maintained for 14 to 60 days. Similar effects are observed for other species, although the data sets are less reliable. Adverse effects on habitat, especially spawning and rearing habitat presumably from sediment deposition, were noted at similar concentrations of suspended sediment.

Organic suspended materials can also settle to the bottom and, due to their high carbon content, lead to low intergravel DO through decomposition.

In addition to these direct effects on the habitat and spawning success of fish, detrimental changes to food sources may also occur. Aquatic insects, which serve as a primary food source for fish, are affected by excess sedimentation. Increased sedimentation leads to a macroinvertebrate community that is adapted to burrowing, thereby making the macroinvertebrates less available to fish. Community structure, specifically diversity, of the aquatic macroinvertebrate community is diminished due to the reduction of coarse substrate habitat.

Settleable solids are defined as the volume (milliliters [ml]) or weight (mg) of material that settles out of a liter of water in one hour (Franson et al. 1998). Settleable solids may consist of large silt, sand, and organic matter. Total suspended solids (TSS) are defined as the material collected by filtration through a 0.45 µm (micrometer) filter (Standard Methods 1975, 1995). Settleable solids and TSS both contain nutrients that are essential for aquatic plant growth. Settleable solids are not as nutrient rich as the smaller TSS, but they do affect river depth and substrate nutrient availability for macrophytes. In low flow situations, settleable solids can accumulate on a stream bottom, thus decreasing water depth. This increases the area of substrate that is exposed to light, facilitating additional macrophyte growth.

2.4 Summary and Analysis of Existing Water Quality Data

Water quality data available for the Beaver-Camas Subbasin was provided by multiple government agencies collecting data in the watershed, as shown by appendix D. All continuous flow data was provided by the USGS. Water column data, such as stream temperatures, nutrient, pathogen, etc. was collected by the DEQ and BLM. Temperature data was provided by the BLM, USFS, and DEQ. DEQ has contributed BURP, streambank erosion inventory, and subsurface sediment data. The BLM provided information on riparian conditions. DEQ, IDFG, USFS, and BLM collected and provided fish data.

Flow Characteristics

As discussed in section 1.2 of this document, the Beaver-Camas Subbasin has very unique hydrologic features. Two of the most distinct are: 1) the massive natural infiltration of stream surface water and 2) the introduction of groundwater via wells into Camas Creek and ultimately Mud Lake.

USGS gauge station data is available for Beaver and Camas Creeks (Figure 32). As shown in Table 15, active and inactive station data available. It is useful to evaluate data from inactive stations because it allows for the opportunity to look at historic trends and gain an impression of long term hydrologic cycles in the watershed.

Table 15. USGS gauge station data.

Station Name and Number	Location	Period of Record	Drainage Area (mi^2)	Highest Annual Mean (cfs)	Lowest Annual Mean (cfs)	Highest Monthly Mean (cfs)	Lowest Monthly Mean (cfs)
Camas Creek near Kilgore 13109000	N44.28333° W111.91667°	1921-1930	215	ND	ND	691 (May 1921)	11.9 (Jun 1924)
Camas Creek at Red Rd nr Kilgore 13108900	N44.28889° W111.89389°	1985-1991		125 (1986)	31 (1991)	519 (May 1986)	1.63 (Aug 1991)
Camas Creek at 18Mile near Kilgore 13108500	N44.29722° W111.90566°	1937-1973	210	158 (1971)	55 (1949)	1141 (May 1969)	2 (Feb 1949)
Camas Creek near Camas 13111500	N44.07028° W112.19778°	1921-1926	285	14.4 (1925)	35.7 (1925)	229 (May1921)	6.65 (Dec 1924)
Camas Creek at Camas 13112000	N44.00278° W112.22000°	1925-2003	400	91.8 (1995)	0.8 (1934)	536 (June 1952)	0
Beaver Creek at Spencer 13113000	N44.35556° W112.17778°	1940-1993	220	79.9 (1971)	10.8 (1992)	387 (1969)	0 (1988)
Beaver Creek at Dubois 13113500	N44.18611° W112.23556°	1921-1987	220	197.8 (1969)	0 (1934)	473 (June 1969)	0
Beaver Creek near Camas 13114000	N44.00750° W112.22361°	1921-1991	510	45.8 (1969)	0	213 (1969)	0

The gauge station data depicted in Figures 33 through 48, adequately illustrates how diverse the hydrology in the subbasin is. Stations #13109000 (1921-1930), #13108500 (1937-1973), and #13108900 (1985-1991) are all located near the headwaters of Camas Creek, near Eighteenmile. The three datasets combined, roughly cover streamflow from 1921 through

1991 showing that flows are maintained in Camas Creek all year long and that there is a significant peak in the spring with an all time high streamflow recorded in 1969 in excess of 2500 cubic feet per second (cfs). Figures 33 through 38 show that on an annual basis the flows are very divergent with peaks roughly averaging around 800 cfs and base flows nearing 10 cfs.

The two remaining stations on Camas Creek are located downstream near Camas. The older station (#13111500) recorded flow data from 1921-1926 and the active station (#13112000) has been recording data since 1925. As shown by Figures 39 through 42, the highest peak recorded occurred in 1997 around 1500 cfs. The station data illustrates that since the mid 1980’s streamflows in Camas Creek, at Camas have consistently reached zero cfs on a seasonal basis.

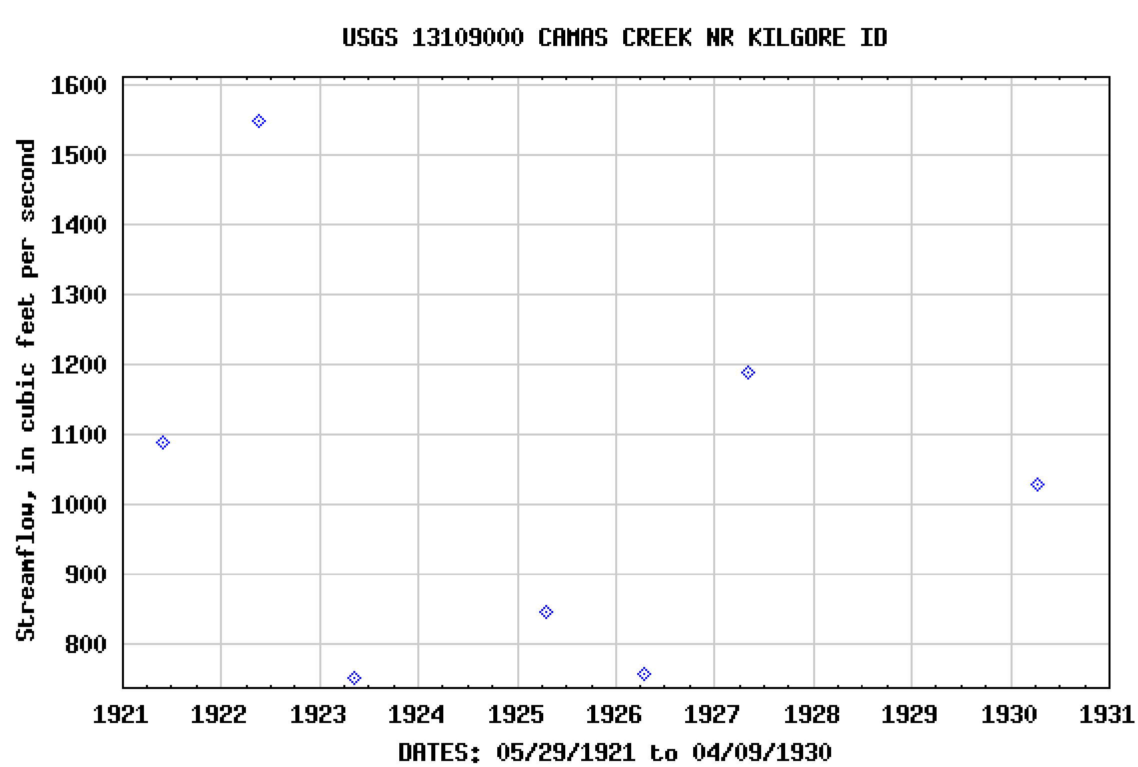

Figure 33. Peak Streamflow (cfs) for station# 1310900, Camas Creek near Kilgore, ID (1921-1930).

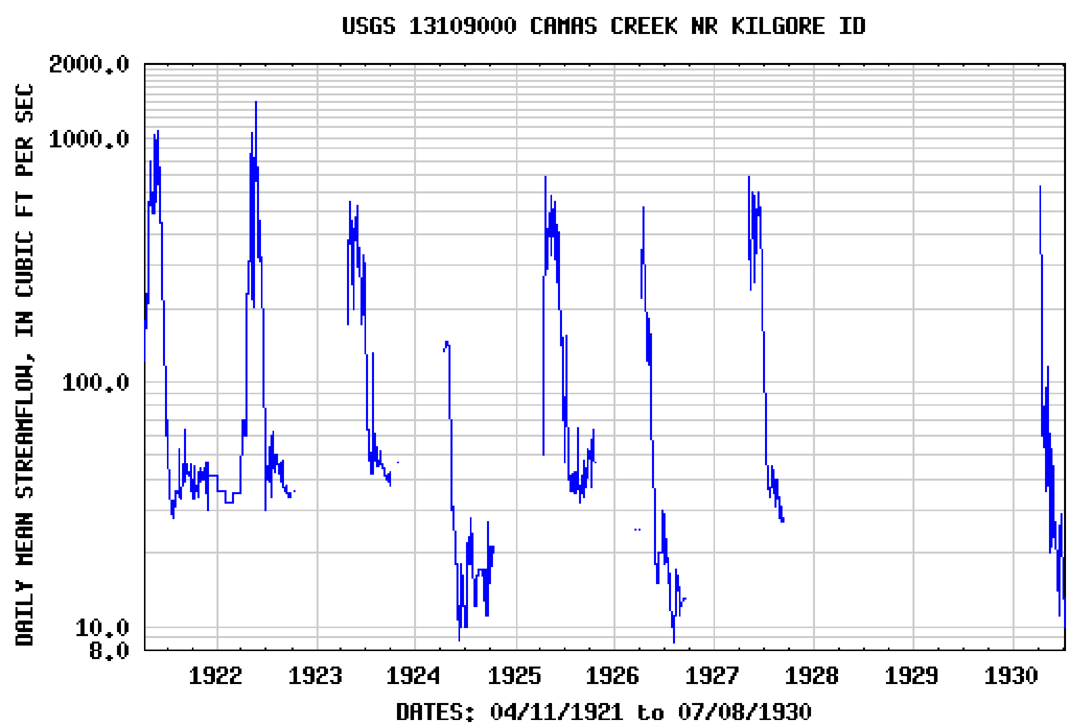

Figure 34. Daily Mean Streamflow (cfs) for Station #13108500, Camas Creek near Kilgore, ID (1921-1930).

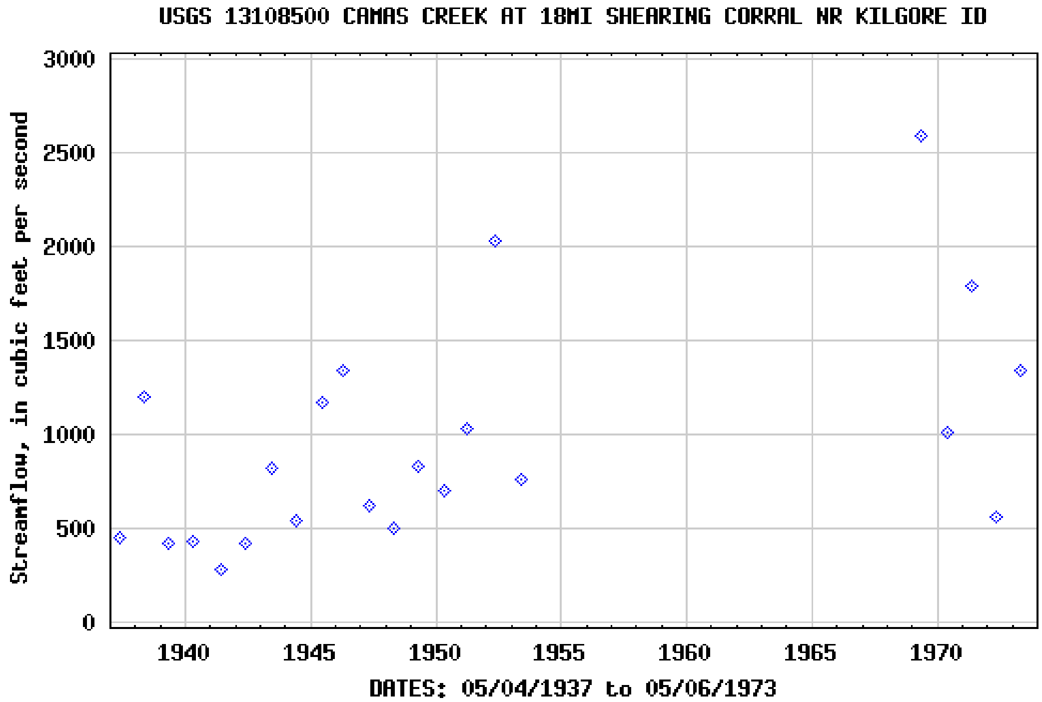

Figure 35. Peak Streamflow (cfs) for Station #13108500, Camas Creek at 18 mile Shearing Corral near Kilgore, ID (1937-1973)

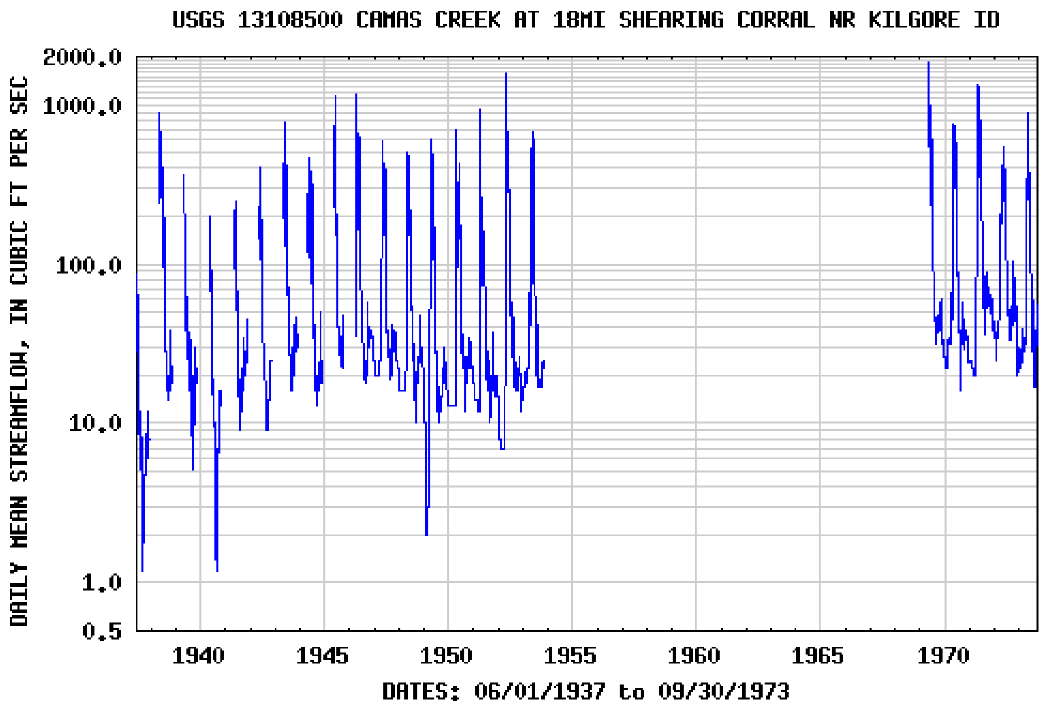

Figure 36. Daily Mean Streamflow (cfs) for Station #13108500, Camas Creek at 18 mile Shearing Corral near Kilgore, ID (1937-1973).

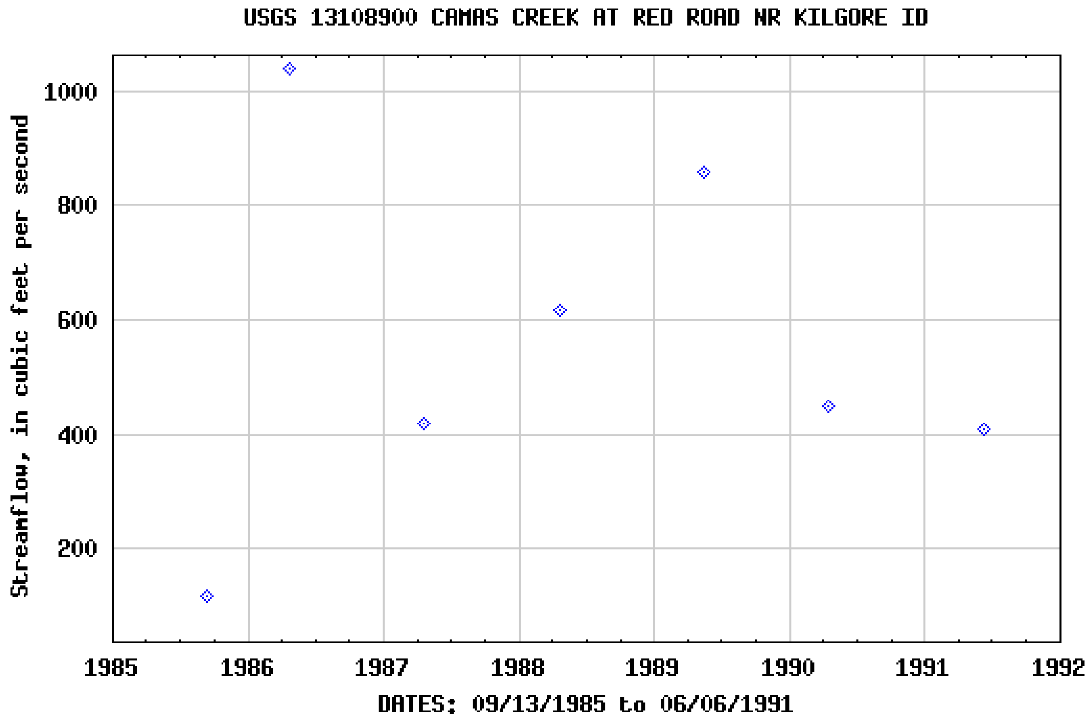

Figure 37. Peak Streamflow (cfs) for Station #1308900, Camas Creek at Red Road Near Kilgore (1985-1991).

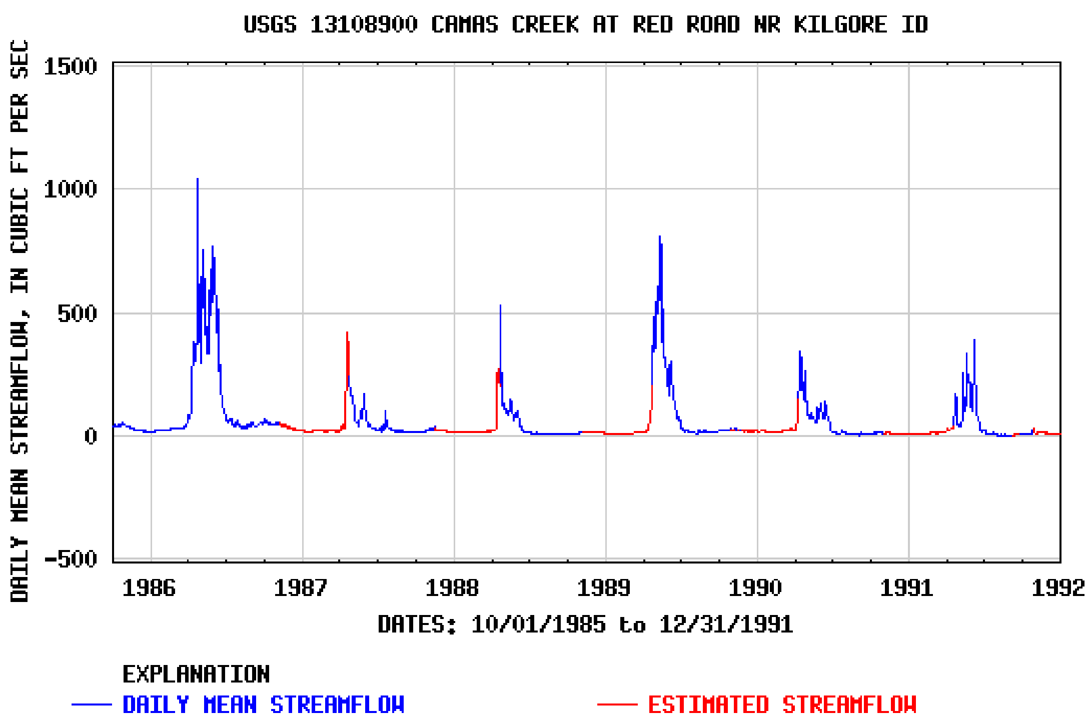

Figure 38. Daily Mean Streamflow (cfs) for Station #1308900, Camas Creek at Red Road Near Kilgore (1985-1991).

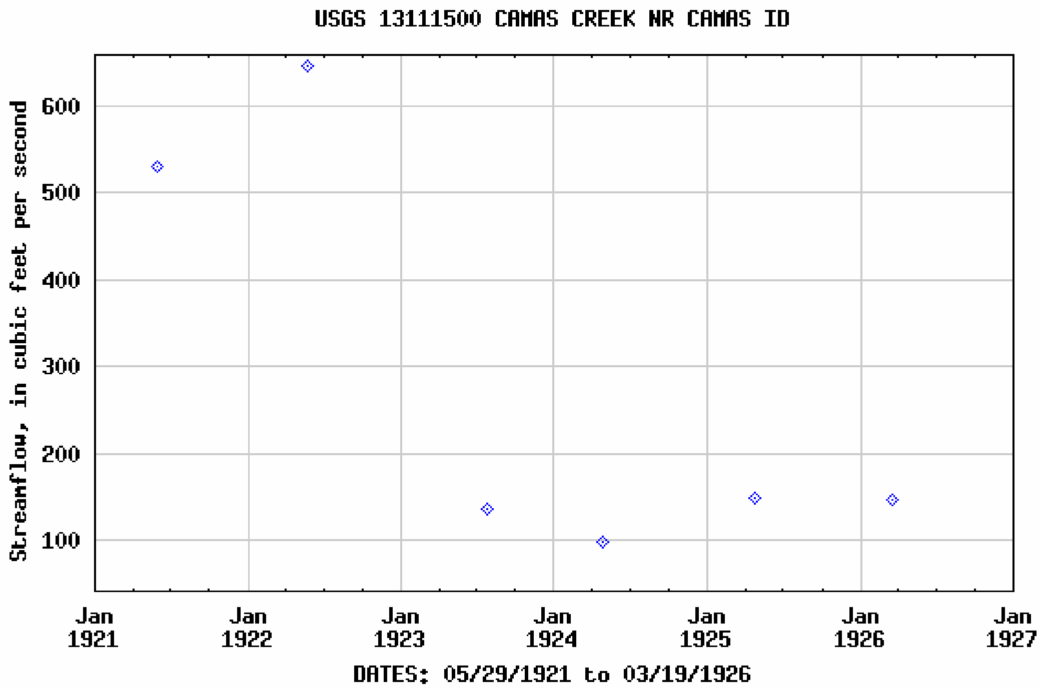

Figure 39. Peak Streamflow (cfs) for Station #1308900, Camas Creek Near Camas, ID (1921-1926).

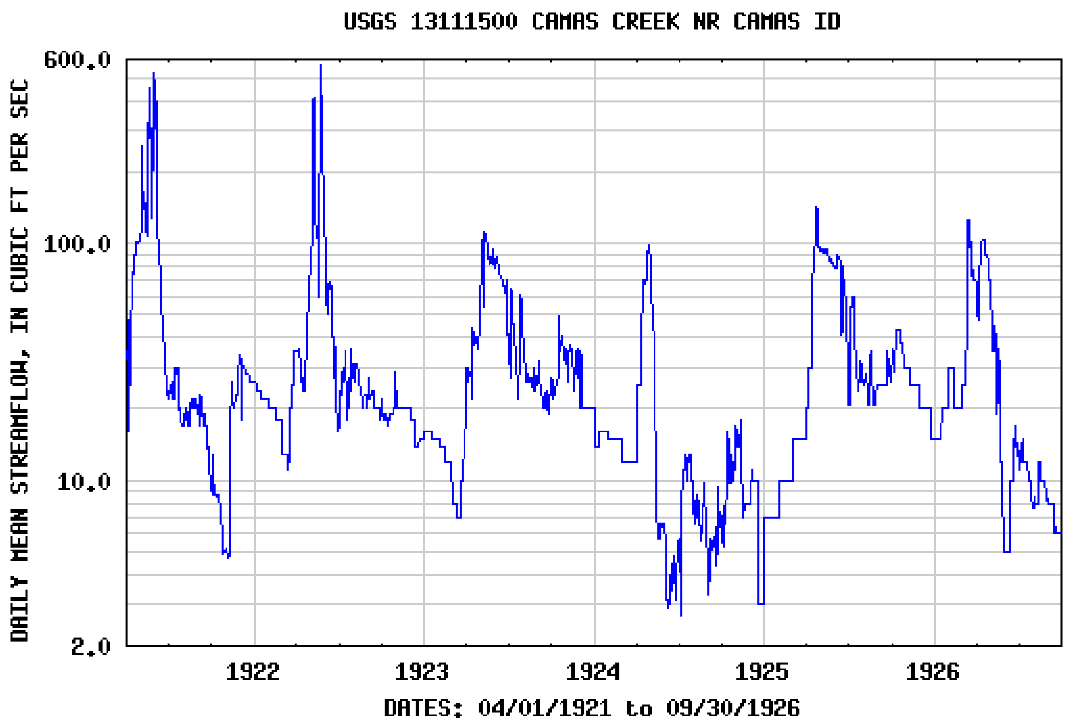

Figure 40. Daily Mean Streamflow (cfs) for Station #1308900, Camas Creek Near Camas, ID (1921-1926).

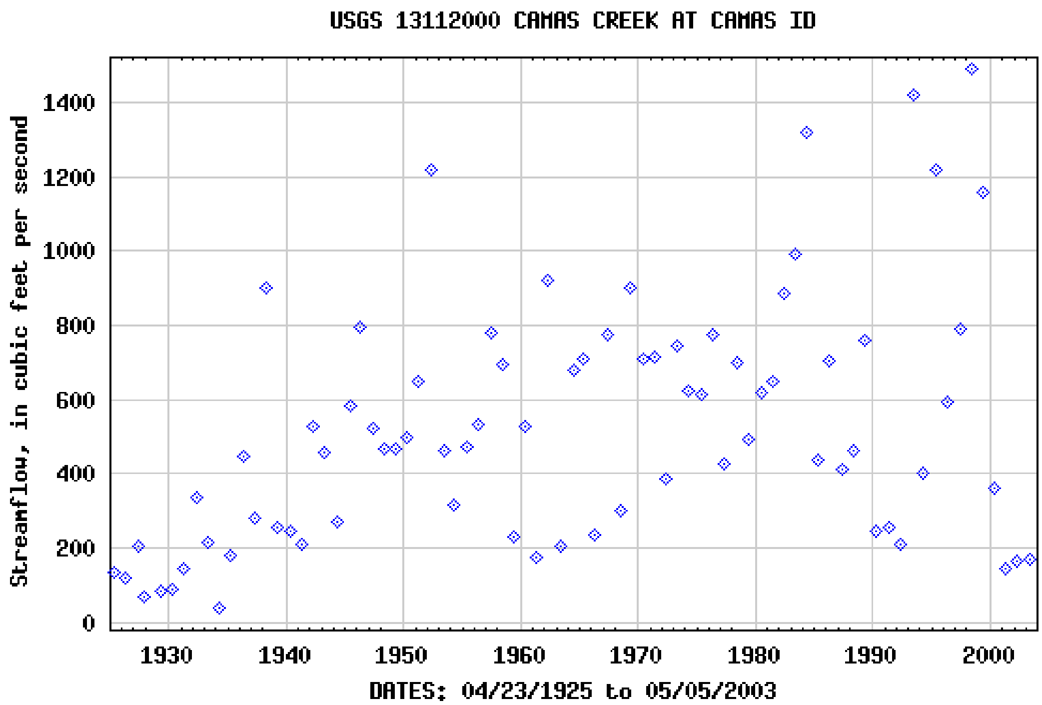

Figure 41. Peak Streamflow (cfs) for Station #13112000, Camas Creek at Camas, ID (1925-2003).

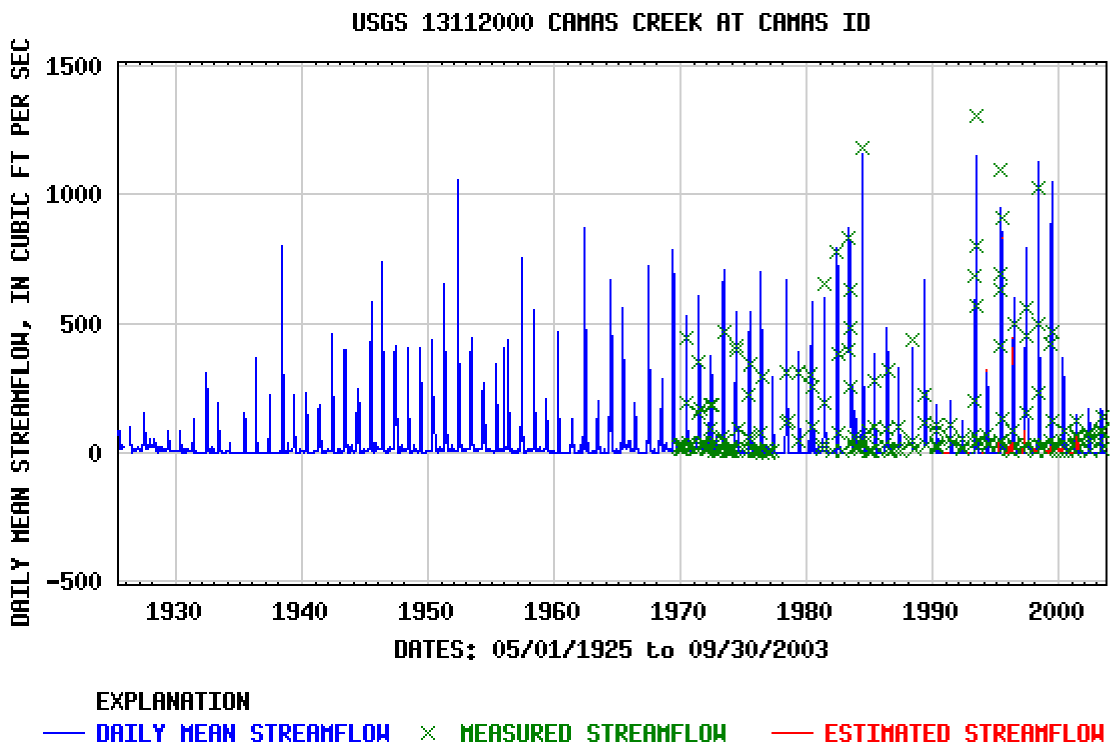

Figure 42. Daily Mean Streamflow (cfs) for Station #13112000, Camas Creek at Camas, ID (1925-2003).

USGS gauge station data is available for three locations (Figure 32) on Beaver Creek, station #1311300 (1940-1993), at Spencer, station #13113500 (1921-1987) at Dubois, and station #13114000 (1921-1991), near Camas.

The station at Spencer shows that a maximum peak streamflow near 1200 cfs was achieved in 1975, as shown in Figure 43. Daily mean data (Figure 44) for this station shows that Beaver Creek streamflow is perennial in this location.

Peak streamflow data (Figure 45) for Beaver Creek at Dubois show that a high peak around 850 cfs was achieved in 1930 and a low of zero cfs was recorded four years later in 1934. Figure 46 shows that Beaver Creek quite often does not sustain a year round flow. Since the data is only through 1987, it should be noted that locals recollect that an annual sustained flow was not achieved in the 1990's or early 2000's.

The furthest downstream gauge station is located further downstream in Camas. A maximum peak nearing 500 cfs was recorded in 1984 and minimums of zero cfs are commonly recorded (Figure 47). Figure 48 shows that Beaver Creek, in this location, is not perennial. A peak is sometimes observed in the early spring for a couple of weeks during the peak spring runoff and then the stream remains dry for the rest of the year.

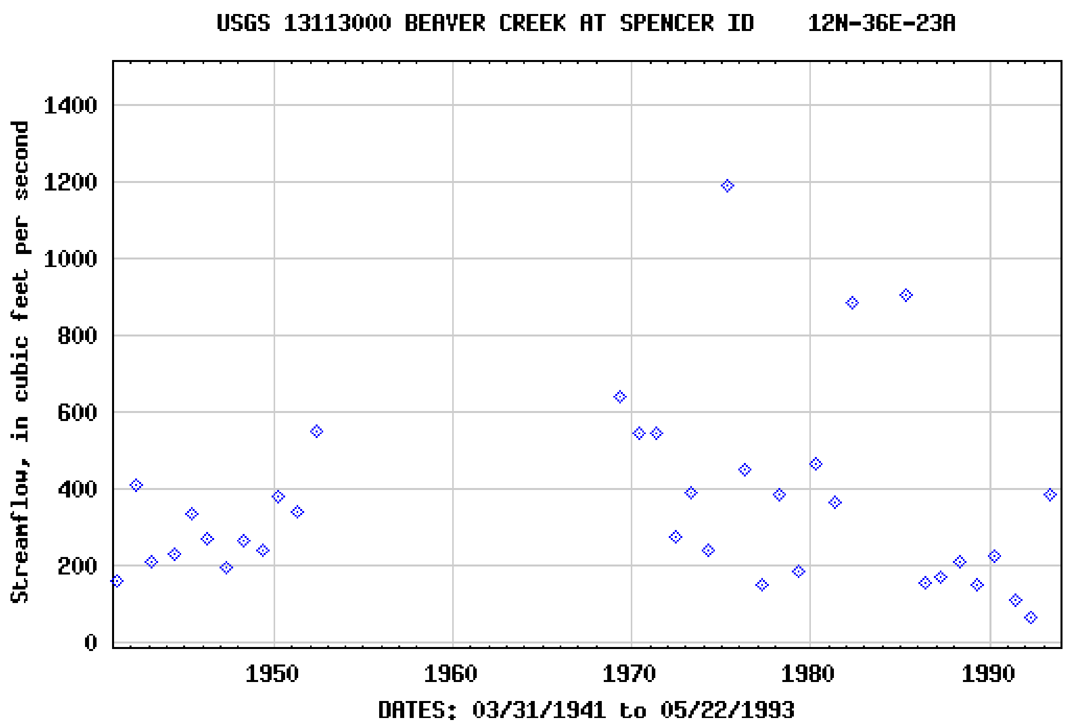

Figure 43. Peak Streamflow (cfs) for Station #13113000, Beaver Creek at Spencer (1940-1993).

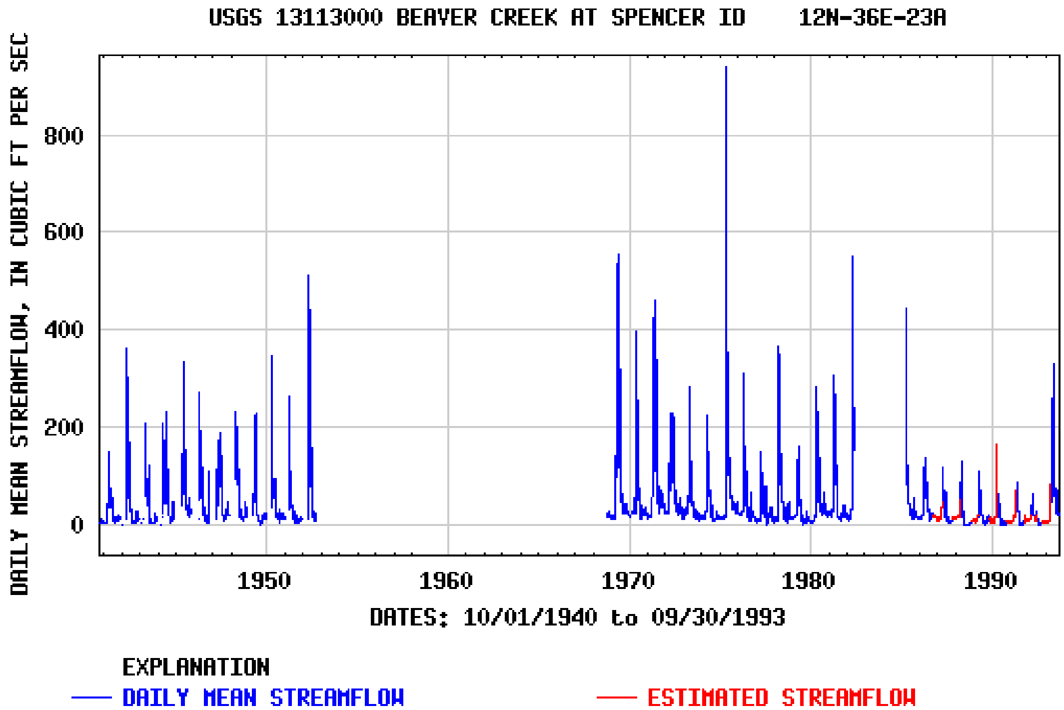

Figure 44. Daily Mean Streamflow (cfs) for Station #13113000, Beaver Creek at Spencer (1940-1993).

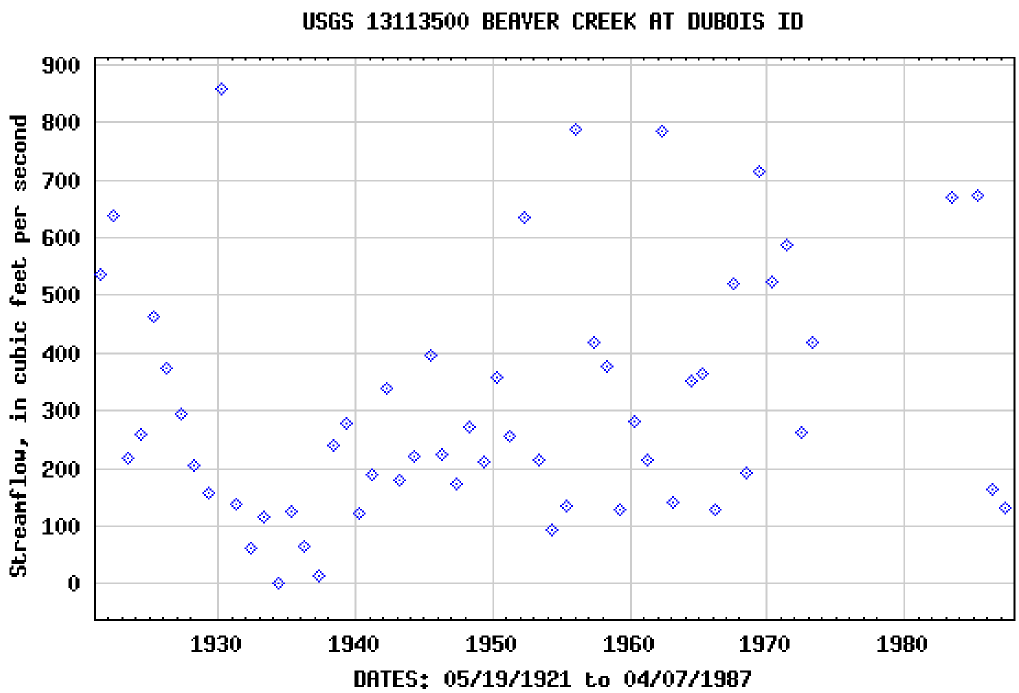

Figure 45. Peak Streamflow (cfs) for Station #13113500, Beaver Creek at Dubois (1921-1987).

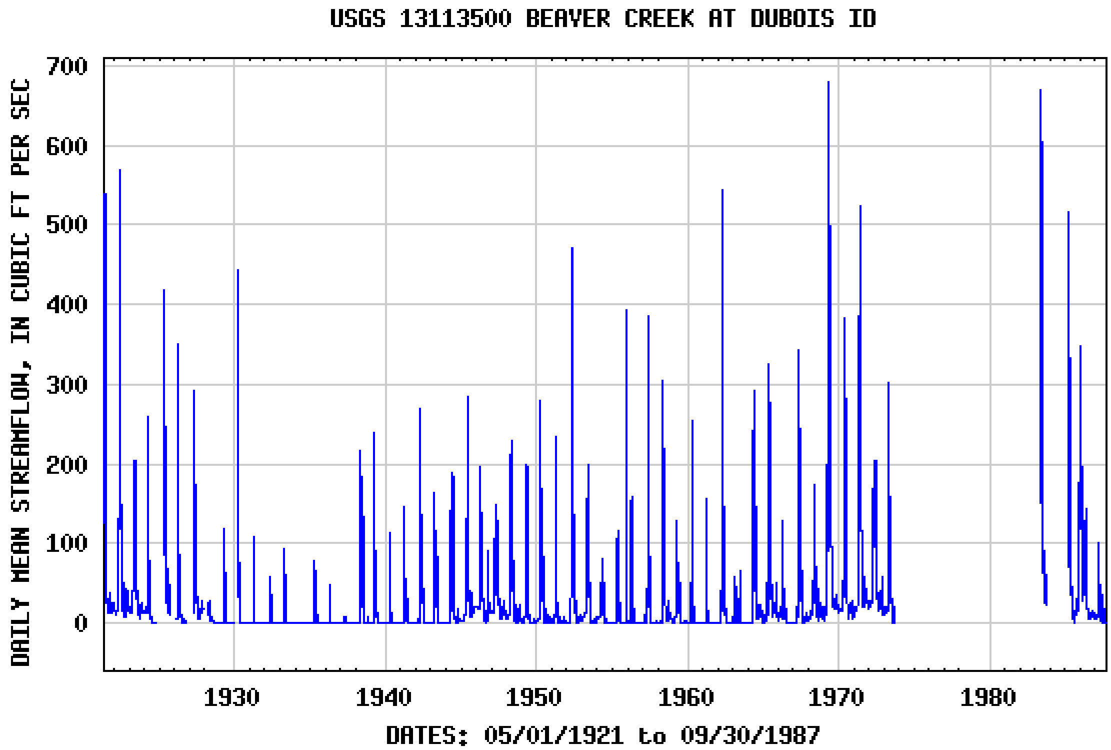

Figure 46. Daily Mean Streamflow (cfs) for Station #13113500, Beaver Creek at Dubois (1921-1987).

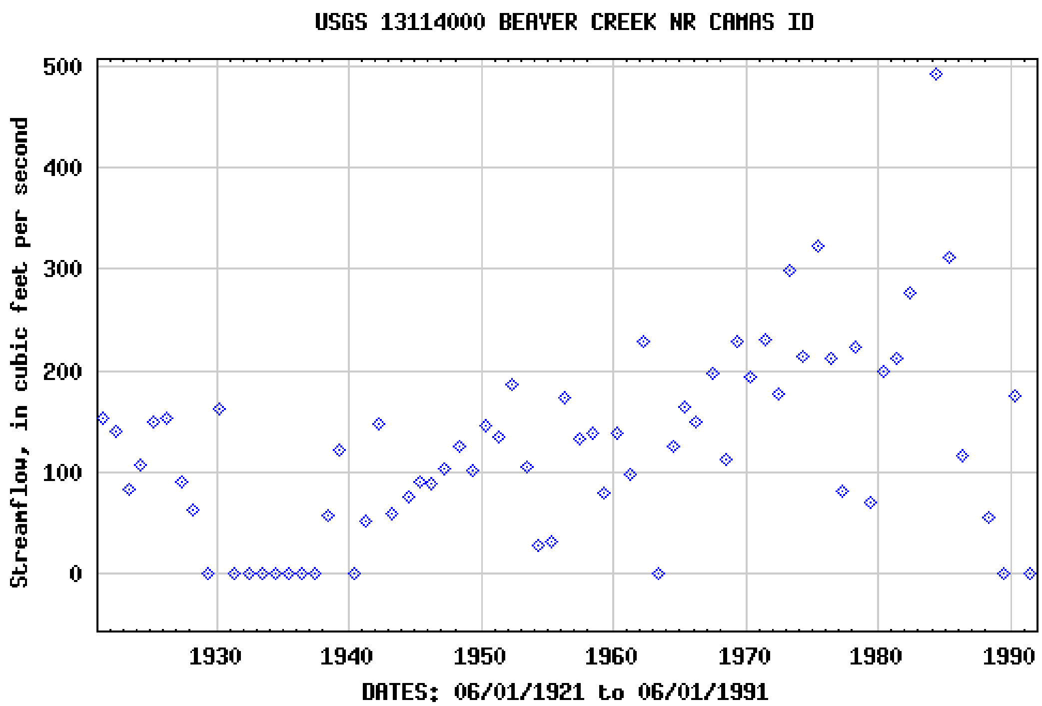

Figure 47. Peak Streamflow (cfs) for Station #13114000, Beaver Creek at Dubois (1921-1991).

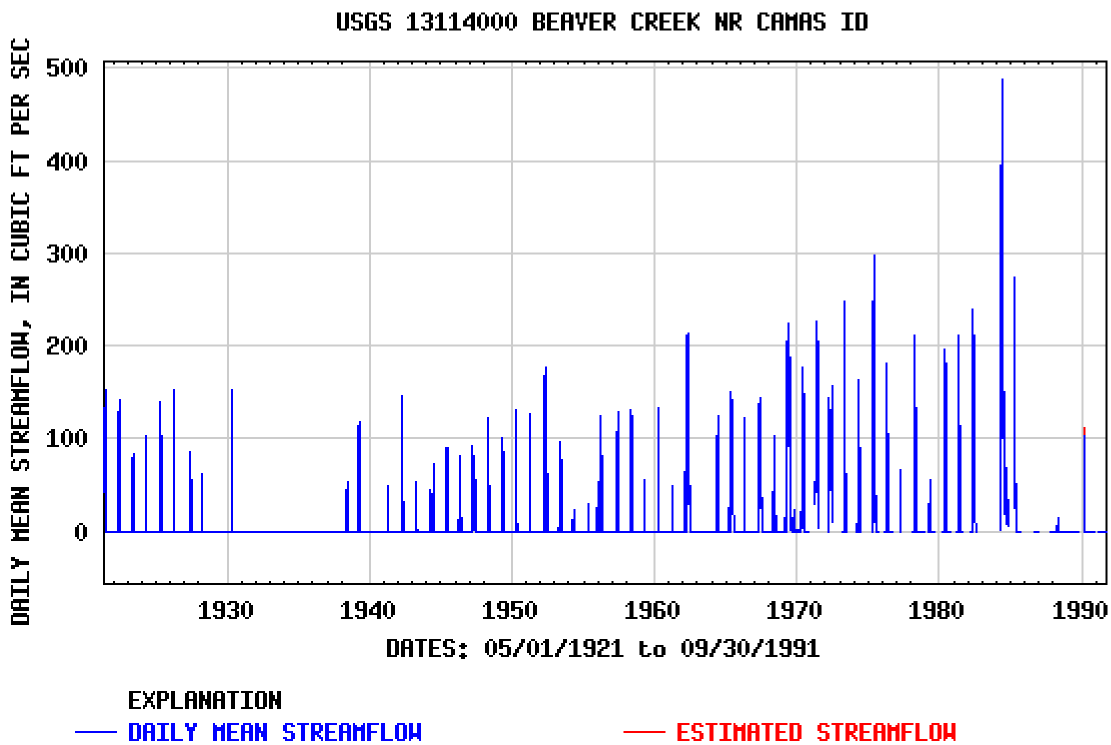

Figure 48. Daily Mean Streamflow (cfs) for Station #13114000, Beaver Creek at Dubois (1921-1991).

Water Column Data

Stream Temperature Data

DEQ and USFS have collected stream temperature data in the Beaver-Camas Subbasin (Tables 16-19). DEQ stream temperature data was collected in 2004 from May through October. Thermologgers were placed in Beaver Creek, Stoddard Creek, Camas Creek, Miners Creek, Dairy Creek, Modoc Creek, Threemile Creek, Crooked Creek, and West Fork Rattlesnake Creek. USFS maintained three temperature sensor locations in the subbasin, data was collected on USFS property in Beaver Creek (above Spencer) from 2000 through 2003, in West Camas Creek in 2002, and in East Camas Creek in 2003.

Raw stream temperature data was obtained and evaluated for State of Idaho water temperature criteria for all of these sites. These criteria are in two categories: cold water aquatic life (CWAL) and salmonid spawning (SS). The temperature criteria for CWAL is 22°C (66.2°F) or less, with a maximum daily average of no greater than 19°C (71.6°C). A CWAL criterion is evaluated for the summer season (June 22 through September 21). The criterion for salmonid spawning is 13°C (55.4°F) or less with a maximum daily average no greater than 9°C (48.2°F). (IDAPA 58.01.02.250.02) According to IDFG, spring SS generally occurs between the first of May and the middle of July. Fall spawning is known to occur from September 15th through November 15th (Fredericks 2004).

A major exceedance of temperature criteria occurs when the criteria are exceeded 10% of the time. See Tables 16-19 for temperature exceedances on each site and the thermograph location(s) for each stream. Major exceedances (>10%) are shaded in gray on the tables.

As shown in Tables 16 and 17, stream temperature data was collected in 2004 by the DEQ in ten locations. Stream temperatures were collected in two temperature listed reaches; Beaver Creek (Spencer gauge) and Camas Creek (headwaters). Stream temperature data show that major exceedances for CWAL and SS were documented in 2004. In Beaver Creek, major exceedances for the 22°C instantaneous CWAL and SS criteria were documented.

Crooked Creek is severely flow altered and flows are significantly reduced and temperatures are not representative natural stream hydrology. Threemile Creek, above the logger site, is flow altered however, flows above near one cfs are maintained in the stream year long. Hydrologically, West Fork Rattlesnake Creek is an intermittent stream with a dry streambed naturally occurring early in the summer. In 2004, stream flows in Miners Creek and Stoddard Creek were less than one cubic feet per second from May through October however, it is known that flows above one cfs are usually maintained in both of the streams.

Dairy Creek and Modoc Creek sample sites maintained constant flows above one cfs the entire summer. No major exceedances in the CWAL criteria were evaluated however, major exceedances in the SS criteria were documented in all four locations.

Three temperature measurement sites were maintained by the USFS in 2000-2003. As shown in Figures 18 and 19 this data yielded an exceedance in the CWAL criteria on Beaver Creek in 2002 and 2003 and major exceedances of the SS criteria on all three streams, every year sampled.

Table 16. 2004 DEQ temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria during the entire monitoring period.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Date Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Beaver Creek, Spencer Gauge	06/21/04-09/22/04	94	10	24.01	13-Aug	2	19.35	16-Jul
Stoddard Creek, near Mouth	06/21/04-09/22/04	94	0	20.19	14-Jul	0	15.71	15 -Jul
Camas Creek, Mouth @ Gauge	06/21/04-09/22/04	94	31	26.34	16-Jul	31	22.49	16-Jul
*Miners Creek, @ near Sheep Cr Rd.	06/21/04-09/22/04	94	8	25.2	17-Jul	2	19.72	17-Jul
Dairy Creek, Rd x-ing near mouth	06/21/04-09/22/04	94	3	22.86	16-Jul	0	17.9	16-Jul
Modoc Creek, mouth	06/21/04-09/22/04	94	0	20.02	23-Jun	0	14.74	17-Jul
Modoc Creek, forest boundary	06/21/04-09/22/04	94	0	20.95	17-Jul	0	14.83	17-Jul

*Crooked Creek, BLM	06/21/04-09/22/04	94	0	20.19	14-Jul	0	16.84	15-Jul
*Threemile Creek, Kligore Rd X-ing	06/21/04-09/22/04	92	53	29.4	16-Jul	4	19.92	16-Jul
* W. Fk. Rattlesnake, Kilgore Rd X-ing	06/21/04-06/25/04	5	3	24.8	23-Jun	0	15.8	24-Jun

* indicates flow altered or intermittent stream

Table 17. 2004 DEQ temperature data and number of days where water temperatures exceeded the salmonid spawning criteria during the entire monitoring period.

		Salmonid Spawning						
			13°C Inst.			9°C Daily Ave.		
Stream Name	**Date Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Beaver Creek, Spencer Gauge	05/05/04-7/15/04 09/15/04-10/24/04	112	61	23.24	15-Jul	80	19.09	15-Jul
Stoddard Creek, near Mouth	05/05/04-7/15/04 09/15/04-10/24/04	112	50	20.19	14-Jul	53	15.73	19-Jul
Camas Creek, headwaters @ Gauge	05/06/04-07/15/04 9/15/04-10/24/04	111	65	25.95	15-Jul	85	22.06	15-Jul
*Miners Creek, @ near Sheep Cr Rd.	05/06/04-07/15/04 9/15/04-10/24/04	112	71	23.6	15-Jul	73	18.97	15-Jul
Dairy Creek, Rd x-ing near mouth	05/05/04-07/15/04 9/15/04-10/24/04	112	58	22.48	15-Jul	62	17.84	15-Jul
Modoc Creek, mouth	05/05/04-07/15/04 9/15/04-10/24/04	112	50	20.02	23-Jun	47	14.46	15-Jul
Modoc Creek, forest boundary	05/05/04-07/15/04 9/15/04-10/24/04	112	46	20.19	15-Jul	41	14.71	15-Jul
*Crooked Creek, BLM	05/06/04-07/15/04 9/15/04-10/24/04	111	47	20.19	14-Jul	51	16.84	15-Jul
*Threemile Creek, Kligore Rd X-ing	05/05/04-07/15/04 9/15/04-10/24/04	112	76	27.5	15-Jul	79	19.1	15-Jul
* Fk Rattlesnake, Kilgore Rd X-ing	05/05/04-07/15/04 9/15/04-10/24/04	52	30	24.8	23-Jun	24	15.8	24-Jun

Table 18. 2000, 2001, 2002, and 2003 USFS Temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria during the entire monitoring period.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Date Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Beaver Creek, above Spencer	07/08/00-09/21/00	76	1	22.06	30-Jul	0	18.83	31-Jul
Beaver Creek, above Spencer	06/21/01-09/03/01	74	0	20.2	03-Jul	0	18.03	07-Jul
Beaver Creek, above Spencer	06/21/02-09/22/02	92	12	23.9	13-Jul	6	19.7	15-Jul

Beaver Creek, above Spencer	06/26/04-09/04/03	71	23	25.2	21-Jul	16	21.2	24-Jul
West Camas Creek	06/21/02-09/22/02	92	5	22.7	15-Jul	4	20.0	15-Jul
East Camas Creek	06/26/03-09/22/03	88	0	20.7	24-Jul	0	16.4	24-Jul

Table 19. 2000, 2001, 2002, and 2003 USFS Temperature data and number of days where water temperatures exceeded the salmonid spawning criteria during the entire monitoring period.

		Salmonid Spawning						
			13°C Inst.			9°C Daily Ave.		
Stream Name	Date Period	# Days Evaluated	# Days Over	Max Temp	Max Date	# Days Over	Max Temp	Max Date
Beaver Creek, above Spencer	07/08/00-07/15/00 09/15/00-09/21/00	15	13	21.73	15-Jul	14	17.48	15-Jul
Beaver Creek, above Spencer	06/16/01-07/15/01	30	30	20.24	03-Jul	30	18.31	03-Jul
Beaver Creek, above Spencer	06/20/02-07/15/02 09/15/02-09/22/02	57	30	23.92	13-Jul	33	19.74	15-Jul
Beaver Creek, above Spencer	06/26/03-07/15/03	20	20	23.52	12-Jul	20	19.42	12-Jul
West Camas Creek	06/15/02-07/15/02 09/15/02-09/22/02	62	34	22.68	15-Jul	37	20.04	15-Jul
East Camas Creek	06/26/03-07/15/03 09/15/03-09/22/03	29	19	18.94	11-Jul	19	13.52	14-Jul

Nutrient Data

Excessive concentrations of nutrients, specifically nitrogen and phosphorous, may diminish water quality and impair beneficial uses through the process of eutrophication. According to IDAPA 58.01.02.200.06, surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growth impairing designated beneficial uses. To protect against the impairment of designated beneficial uses due to excess nutrients, numeric targets have been established by the EPA at 0.1 mg/L Total Phosphorus (TP) in streams not discharging directly into a lake or reservoir, 0.05 mg/L TP in streams were the water enters the reservoir, and 0.3 mg/L nitrate (NO_3) + Nitrite (NO_2) Nitrogen. (EPA 1986)

Table 20 shows the nutrient associated data for several locations in the Beaver-Camas Subbasin. The data was collected by the DEQ in 2004 and in one location on Beaver Creek by the BLM in 2004. Every location met the nutrient criteria, with the exception of one, the E. Fk. Rattlesnake Creek site. Nitrate (NO_3) + Nitrite (NO_2) Nitrogen concentrations were 1.08, significantly above the 0.3 mg/L criteria.

Table 20. DEQ and BLM Nutrient Monitoring Data.

Location	Date	Flow (cfs)	E.coli (CFU/100ml)	NO3/NO2 as N (mg/L)	TKN (mg/L)	Ortho-phosphate PO4 (mg/L)	Total P (mg/L)

Beaver Creek – BLM Site (Upper at BLM exclosure)	08/24/04			0.23	0.23	0.014	0.031
Beaver Creek (Spencer gauge)	05/04/04			<0.05	<0.05	<0.05	<0.05
Beaver (Humphrey)	05/03/04		<2	<0.05	<0.05	<0.05	<0.05
Ching Creek (BLM Property)	05/04/04		43	<0.05	<0.05	<0.05	<0.05
	07/22/04		613	<0.05	0.94	<0.05	0.05
Camas Creek (upper gauge)	05/24/04			<0.05	<0.05	0.05	0.06
	07/22/04			<0.05	0.94	0.05	0.09
Crooked Creek (BLM Property)	05/24/04	2.0		<0.05	1.01	<0.05	<0.05
	07/21/04		345	<0.05	0.85	<0.05	0.08
Modoc Creek (forest boundary)	05/03/04	1.1	228	<0.05	<0.05	<0.05	<0.05
	07/21/04		980	<0.05	0.85	<0.05	0.08
Modoc Creek (upper at ford)	05/03/04		20	<0.05	<0.05	<0.05	<0.05
E. Fk. Rattlesnake Creek (Kilgore Rd. X-ing)	05/04/04		5	1.08	<0.05	<0.05	<0.05
	05/24/04			0.96	<0.05	<0.05	<0.05
Stoddard Creek (service rd x-ing)	05/03/04	0.5	13	<0.05	<0.05	<0.05	<0.05
Dairy Creek (Rd X-ing near mouth)	05/04/04	1.5		<0.05	<0.05	<0.05	0.05
Miners Creek (abandoned ford near Sheep Cr. Rd)	05/04/04	0.7	75	<0.05	<0.05	<0.05	<0.05
Threemile Creek (Kilgore Rd. X-ing)	05/04/04	7.7	115	<0.05	<0.05	<0.05	<0.05
Warm Creek (Kilgore Rd X-ing)	05/04/04		53	<0.05	<0.05	<0.05	<0.05

Pathogen Data

Microorganisms are ubiquitous in the environment, many of which perform beneficial functions. However, there is a small set of microorganisms, known as pathogens, which are responsible for causing disease. *E. coli* serves as an indicator organism for pathogens with the potential to impact human health.

E. coli is easily transported to streams via storm water runoff and other nonpoint and point source discharges. Once *E. coli* has entered a waterbody, it has the potential to impact human health through the ingestion of excessive bacteria. Because of this, water quality standards for *E. coli* are based on the potential for swimming associated illness in waters with various quantities of *E. coli* organisms present over time. Where *E. coli* is concerned, water quality protection is geared toward those streams where recreation and public water supplies are beneficial uses.

Idaho's Water Quality Standards (IDAPA 58.01.02.521) specify that *E. coli* levels should not exceed an instantaneous measurement of 406 colony forming units (cfu)/100 mL for primary contact recreation (PCR) and 576 cfu/100 mL for secondary contact recreation (SCR) or a monthly geometric mean of 126 cfu/100 mL for both PCR and SCR. However, according to IDAPA 58.01.02.080.03 a single water sample exceeding an E.coli standard does not in itself constitute a violation of water quality standards so additional samples must be taken for the purpose of comparing the results to the geometric mean criteria. An exceedance of the geometric mean criteria constitutes a water quality violation.

In 2004 two exceedances of the instantaneous SCR criteria were observed in Ching Creek and Modoc Creek in July 2004. Further geometric mean sampling will be conducted in 2005 to determine if a violation of water quality criteria exists.

Biological and Other Data

Surface Fines

Since 1993, DEQ has collected water quality data through the Beneficial Use Reconnaissance Program (BURP). The BURP program characterizes water quality based on biological communities and their attributes. Assessing channel materials is an important key to evaluating the biological function and stability of streams. Channel materials consist of surface particles that make up the bed and banks within the bankfull channel. (Rosgen 1996) One method for evaluating the particle size distribution of streambed sediment is the Wolman Pebble Count. BURP crews conduct Wolman Pebble Counts utilizing a set interval method with a minimum of fifty counts per riffle in three riffle habitat units (DEQ 2002). Counts are obtained from the bankfull width on each side. Included are the margins of the streambed, which are not normally under water and may be more depositional than the main channel. A tally is kept of the size categories into which particles fall based on the intermediate axis diameter. From this data, the percentage of particles in set categories can be determined (DEQ 1998).

Sediment fines are defined as materials <6.35 mm in diameter. They are used as an index of sedimentation and beneficial use impairment (DEQ 2002). Studies have shown that many salmonid species prefer particles of this size or greater for spawning success. Studies show that spawning success is diminished when the proportion of finer materials becomes too great. Fine sediment also affects the living space of insects as well as fish (DEQ 2002).

Surface fines and related data are summarized in Appendix A, DEQ BURP monitoring data.

Subsurface Fines

Determining percent composition of surface and depth fine sediment in spawning habitat is used as a complimentary target to track changes in sediment loading over time. Since it is believed that surface fines can easily be swept away by spawning fish, subsurface sediment core samples are more biologically meaningful. Research has shown that subsurface fine sediment composition is important to egg and fry survival, Hall (1986), Reiser and White (1988). McNeil and Ahnell (1964) state that, “size composition of bottom materials greatly influences water quality by affecting rates of flow within spawning beds and ranges of exchange between intragravel and stream water”. According to Bjornn, Peery, and Garmann (1998), “Salmonid embryo survival and fry emergence are inversely related to the amount of fine sediment in stream substrates.” Fine sediment can decrease the amount of dissolved oxygen (DO) available to developing embryos by impeding flow of water through the substrate and through the oxidation of organic material in fine sediment. Low oxygen availability from excess fine sediment has been associated with smaller and less developed emergent fry.”

McNeil Sediment Core samples can describe size composition of bottom materials in identified salmonid spawning locations. McNeil Sediment Core samples are collected by isolating a small area of the stream bottom from the current with an open stainless steel cylinder (12 in). The cylinder is worked to a depth of approximately 4-6 inches into the spawning habitat. Substrate is then removed from the cylinder, washed through a series of ten sieves (63 to .053 mm diameter openings), and then measured via volumetric displacement. Three sediment core samples are obtained for each site and averaged to calculate the percentage of depth fines at the sample location. The percentage of intergravel fines less than 6.35 mm (1/4 in) in diameter is correlated with expected fry survival.

DEQ has a target for volcanic, granitic, and sedimentary watersheds that is less than 28% fine sediment (<6.35 mm diameter) in identifiable spawning habitat. Channel morphology provides flow dynamics that result in fine sediment levels less than 28% in unperturbed conditions. Excessive fine sediment inputs or disturbed channel morphology are indicated by fine sediment compositions above 28%.

In Fall 2003 DEQ collected McNeil depth fine samples in two locations in the Beaver-Camas watershed, Beaver Creek and Camas Creek (Table 21). The Beaver Creek sample site was just above the Miners Creek Confluence on USFS property, above the listed section. Sample results showed that depth fines were just above the target level of 28%, at 28.5% fine materials. The Camas Creek sample site was in the listed reach, below headwaters, sample results yielded a depth fine percentage of 38.4. This is above the target level of 28%.

Table 21. DEQ McNeil Sediment Core sample sites and percentage of depth (4 in) fine sediment.

Stream	Date of data collection	Location	Location Description	% of fine material <6.35 mm
Beaver Creek	10/16/03	N 44.4138° W 112.19732°	At Stoddard Creek exit of I-15	28.5
Camas Creek	10/21/03	N 44.1928° W 111.9817°	upper	38.4

Streambank Assessments

DEQ utilizes streambank erosion inventories (SEI) to assess current erosion conditions within a stream. This method is very useful in identifying load reductions necessary to achieve desired future conditions that are expected to restore beneficial uses to a stream.

DEQ SEIs are conducted in accordance with methods outlined in proceedings from the Natural Resource Conservation Service (NRCS) Channel Evaluation Workshop (NRCS 1983). The NRCS technique measures streambank/channel stability, length of active eroding banks, and bank angles. Streambank and channel stability field measurements are used to ascertain the long-term lateral recession rate. The recession rate is determined from field evaluation of streambank characteristics that are assigned a categorical rating ranging from 0 to 3. The categorical ratings are summed to a cumulative rating. From the cumulative rating a lateral recession rate is assigned ranging from slight at 0.01 ft/yr. to very severe at 0.5 + ft/yr. An average volume of eroded bank is obtained with the estimated recession rate. By applying a measured or estimated standard bulk density based on composition of streambank material an estimate of tons of sediment from streambank erosion is obtained for comparison to other reaches or for applying a load allocation based on a prescribed reference condition. Appendix F outlines the method for conducting SEIs.

It is assumed that natural background sediment loading rates from bank erosion equate to 80% bank stability as described in Overton and others (1995), where banks are expressed as a percentage of the total estimated bank length. Natural condition streambank stability potential is generally 80% or greater for Rosgen A, B, and C channel types in plutonic, volcanic, metamorphic, and sedimentary geology types. Therefore, an 80% bank stability target based on streambank erosion inventories shall be the target for sediment.

The DEQ conducted a streambank erosion inventory on Camas Creek in late October 2004, approximately two miles downstream of Eighteenmile. As shown in Table 22, the inventoried section of Camas Creek was highly erosive, around 76%. This value is well above the 80% stability target.

Table 22. Camas Creek Erosion Inventory Summary

Reach Location	Total Inventoried (ft)	Erosive (ft)	% Erosive	Ave Bank Height (ft)	Ave Recession Rate (ft/yr)
Camas Creek					
upper	1863	1414	76	5.7	0.61

Proper Functioning Condition

Proper Functioning Condition (PFC) is a technique utilized to determine which stream reaches are at greater risk. Inventories for PFC are conducted in the field where stream characteristics, soils, hydrology, and vegetation, are evaluated. Evaluation results are tallied and the reach is classified as being in proper functioning condition (PFC), functional at risk (FAR), or nonfunctional (NF). A stream classified as PFC is considered healthy. A classification of FAR is healthy but at risk whereas a classification of NF is considered an unhealthy reach.

The BLM has conducted PFC surveys in the subbasin in the years of 1994 and 2004. PFC surveys were conducted on BLM land on Beaver Creek near headwaters (Figure 50) and below the Flat Creek confluence (Figure 49). Figures 49 and 50 illustrate the results of the PFC surveys. The surveys showed that all of the sites near headwaters are not in proper functioning condition and that the lower site was PFC in 2004; demonstrating an upward trend in stream health.

Fish Data

Fish distribution and age classes are important for documentation of the existence and status of the fish in the subbasin. DEQ, IDFG, USFS, and BLM collected fish count data (Tables 23-26). Fish data show that brook trout is the most dominant species in the subbasin, the second most abundant is the Yellowstone cutthroat trout, and occasional occurrences of rainbow and brown trout.

From all of the fish data presented below, YCT are located, in the highest abundance in Middle Dry Creek and East Fork Rattlesnake Creek. The low frequency of YCT in the basin is most likely attributed to the introduction of nonnative species (brook trout—BRK), which out-compete the YCT, habitat destruction, and irrigation diversions.

Table 23. DEQ Fish Data Summary

Stream Name	Date Collected	YCT	BRK	RBT	Non-salmonids	comments
Alex Draw	09/17/02		21			70-145 mm
Bear Gulch Creek	08/07/01		13			90-189 mm
Berry Creek	07/21/98		1		(1) sculpin	140-149 mm
Castle Creek	07/22/98		1			130-139 mm
Ching Creek	07/22/98		15			40-219 mm
Ching Creek	08/28/03		58		(10) speckled dace	60-220 mm
Corral Creek	07/15/98	3				90-119 mm
Corral Creek	07/15/98	1				170-179 mm
Cottonwood Creek	07/22/98		8			110-189 mm
Crab Creek	07/08/98	1	1		(2) shiner	140-189 mm
Crooked Creek	08/02/99		5	2		190->300 mm
Dairy Creek	07/09/99		5		(2) sculpin	110-229 mm
Dairy Creek	07/20/98		4	2	(7) sculpin	60-169 mm (BRK), 280-299 mm (RBT)
Dry Creek	07/04/98	5				70-219 mm
E. Camas Creek	07/22/98		14			70-249 mm
E. Camas Creek	08/07/01		53			60-199 mm
E Fk. Rattlesnake	07/15/98	6				70-159 mm
E Modoc Creek	07/21/98	5	26		(6) sculpin	40-209 mm
E Threemile Creek	07/15/98		15			90-199 mm
Horse Creek	07/21/98		4			30-199 mm
Huntley Canyon Creek	08/07/01		6			60-179 mm
Kite Canyon Creek	07/20/98		10			70-229 mm
Little Creek	07/22/98		18			80-199 mm
Long Creek	07/09/99					No Fish
Middle Threemile Creek	07/14/98		5			90-209 mm
Middle Threemile W. Fk	07/14/98		3			100-169 mm
Miners Creek	07/20/98					No Fish
Modoc Creek	07/21/98		8		(18) sculpin	50-229 mm
N. Fk Rattlesnake Creek	07/08/98					No Fish
Pete Creek	07/22/98		17			40-209 mm
Pleasant Valley Creek	07/20/98		5			100-239 mm
Pleasant Valley Creek	07/20/98		15		(5) sculpin	80-149 mm
Pleasant Valley Creek	09/17/02		56		(23) sculpin	60-200 mm

Stream Name	Date Collected	YCT	BRK	RBT	Non-salmonids	comments
Rattlesnake Creek	07/15/98					No Fish
Saw Creek	07/22/98		16			60-219 mm
School Section Creek	07/20/98		4			150-239 mm
Sheep Creek	07/20/98					No Fish
Spring Creek	07/15/98	7	1			90-289 (YCT), 280-289 (BRK)
Spring Creek	07/08/98					Dry
Spring Creek	07/15/65	6				110->429 mm
Steel Creek	07/22/98		41			30-189 mm
Steel Creek	07/17/02		40			35-150 mm
Stoddard Creek	07/20/98		19			30-209 mm
Stump Creek	07/22/98		8			100-139 mm
Threemile Creek	07/15/98					No Fish
Trail Creek	07/08/99		8			100-219 mm
Van Noy Creek	07/20/98					No Fish
West Camas Creek	07/22/98		22			110-249 mm
West Camas Creek	07/08/01		21			60-219 mm
West Camas Creek	08/28/03		16			70-200 mm
West Camas Creek	09/07/04		70		(2) speckled dace	75-195 mm
W Fk Rattlesnake Creek	07/15/98		14			40-269 mm
West Modoc Creek	07/21/98					No Fish
W Threemile Creek	07/14/98		5			80-269 mm
White Pine Canyon Creek	07/20/98		7			40-169 mm

YCT = Yellowstone cutthroat; BRN = brown trout; BRK = brook trout; RBT = rainbow trout; YOY = Young of the Year.

Table 24. IDFG Fish Data Summary

Stream Name	Date Collected	YCT	BRK	BRN	RBT	Non-salmonids	comments
Alex Draw (upper-upper)			26				26-204 mm; 2 pass
Alex Draw (upper)	07/11/02						Dry
Alex Draw (lower)	07/11/02		24				38-192 mm; 1 pass
Calf Creek (upper)	07/12/02						Dry
Calf Creek (lower)	07/12/02						Dry
Ching Creek (upper)	07/13/02						No Fish
Ching Creek (middle)	07/16/02		39				35-200 mm; 2 pass
Ching Creek (lower)	07/15/02					(30) sculpin, (23) dace, (10) sucker	
Cottonwood Creek (middle)	07/12/02		83				35-197 mm; 3 pass; yoy
Cottonwood Creek (upper)	07/12/02		77				33-165 mm; 3 pass
Cottonwood Creek (lower)	07/13/02		66				42-187 mm; 2 pass
Crooked Creek (upper)	07/15/02						No Fish
Crooked Creek (middle)	07/15/02						No Fish
Crooked Creek (lower)	07/15/02						Dry
Middle Dry Creek (upper)	07/13/02						Dry
Middle Dry Creek (middle)	07/13/02						No Fish
Middle Dry Creek (lower)	07/15/02	60					77-252 mm; 2 pass
Middle Dry Creek (lower)	07/13/02						No Fish

Stream Name	Date Collected	YCT	BRK	BRN	RBT	Non-salmonids	comments
E. Fk. Rattlesnake Creek (upper)	07/14/02	81					44-316 mm; 2 pass
E. Fk. Rattlesnake Creek (middle)	07/14/02		6				112-203 mm; 1 pass
E. Fk. Rattlesnake Creek (lower)	07/14/02						Dry
Huntley Canyon Creek (upper)	07/15/02		26				40-223 mm; 2 pass
Huntley Canyon Creek (lower)	07/14/02		14				55-138 mm; 1 pass
Huntley Canyon Creek (middle)	07/14/02		39				42-165 mm; 2 pass
Miners Creek (upper)	06/27/02						No Fish
Miners Creek (middle)	06/27/02						No Fish
Moose Creek (middle)	07/16/02	2	13				45-155 mm (BRK); 150-160 (YCT); 2 pass
Pleasant Valley Creek (upper)	07/11/02		73				32-189 mm; 2 pass; yoy
Pleasant Valley Creek (middle)	07/01/02		83				35-186 mm;1 pass
Pleasant Valley Creek (lower)	07/11/02		36			(3) sculpin	51-227 mm; 2 pass
Rattlesnake Creek	07/14/02						Dry
Spring Creek (upper)	07/14/02						Dry
Spring Creek (middle)	07/14/02						Dry
Spring Creek (lower)	07/14/02						Dry
Spring Creek (lower)	07/16/02		24				54-206 mm; 2 pass
Steel Creek (upper)	07/12/02		37				28-164 mm; 2 pass
Steel Creek (lower)	07/12/02		31				33-160 mm; 2 pass
Threemile Creek (upper)	07/15/02						No Fish
Threemile Creek (lower)	07/13/02						No Fish
Threemile Creek (middle)	07/13/02						No Fish
W. Camas Creek (upper)	07/11/02		32	1			46-192 mm; 1 pass

YCT = Yellowstone cutthroat; BRN = brown trout; BRK = brook trout; RBT = rainbow trout; YOY = Young of the Year

Table 25. BLM Fish Data Summary

<table>
<tr><th>Stream Name</th><th>Date Collected</th><th>YCT</th><th>BRK</th><th>RBT</th><th>Non-salmonids</th><th>comments</th></tr>
<tr><td rowspan="2">Beaver Creek</td><td>08/22/96</td><td></td><td>129</td><td></td><td>(29) sculpin</td><td>72-253 mm</td></tr>
<tr><td colspan="6">55 trout/100 sq meters; 1334 trout/mile (double pass)</td></tr>
<tr><td rowspan="2">Dry Creek</td><td>11/4/98</td><td>116</td><td></td><td></td><td></td><td>55-357 mm</td></tr>
<tr><td colspan="6">YOY Present; 34 YCT/100 sq meters; 1546 YCT/mile (double pass)</td></tr>
<tr><td rowspan="2">Ching Creek</td><td>09/18/00</td><td></td><td>136</td><td></td><td>speckled dace</td><td>68-253 mm</td></tr>
<tr><td colspan="6">31 BRK/100 sq meters (triple pass)</td></tr>
<tr><td rowspan="2">Ching Creek</td><td>09/18/00</td><td></td><td>152</td><td></td><td>speckled dace</td><td>65-245 mm</td></tr>
<tr><td colspan="6">YOY very abundant; 67 BRK/100 sq meters (double pass)</td></tr>
</table>

YCT = Yellowstone cutthroat; BRN = brown trout; BRK = brook trout; RBT = rainbow trout; YOY = Young of the Year

Table 26. USFS Fish Data Summary

Stream Name	Date Collected	YCT	BRK	RBT	BRN	Non-salmonids	comments
Alex Draw Creek	08/19/02		232				50-180 mm
	Three of the fish observed, had shortened operculum. Although stream conditions were less than ideal, there was a substantial population of fish.						
Bear Gulch Creek	09/04/02		404				40-200 mm
	There were no exceptionally large fish caught in Bear Gulch Creek.						
Beaver Creek	09/18/02					124 sculpin	68-253 mm
	Apparently conditions were ideal for sculpin, but less than favorable for any other species of fish. Water flow was very slow and water temperature was warm, (19 degrees Celsius).						
Ching Creek	08/29/02		113				60-200 mm
	Ching Creek supports a population of resident brook trout.						
Dairy Creek	08/26/02		20	7		43 sculpin	70-300 mm
	Given the condition of the stream it was surprising to find anything besides sculpin. In Unit 2, (the beaver dam complex) we caught several fish over 150mm. The rainbow trout we caught were mostly hatchery fish, with the exception of one naturally reproduced rainbow trout. As far as a fishery is concerned, Dairy Creek did hold a substantial amount of fish for the amount of damage the stream has sustained.						
East Fk. Cottonwood Creek	08/26/02						Low Flow
	After a preliminary analysis, we determined not to survey this stream due to the extremely small flows above and below the USFS road, which crosses this stream. It was determined that there was not sufficient habitat for fish in this portion of the stream.						
Pete Creek	08/14/02		140				50-190 mm
	As for aquatic habitat, the overall condition of Pete Creek was poor.						
West Camas Creek	08/06/02		443		7	109 dace, 17 sculpin	Multiple age classes
	The different age classes for the salmonid species (Brown Trout and Brook Trout) are found here suggesting that the habitat types for fish reproduction are present. Undoubtedly, the historic Yellowstone Cutthroat populations found in the West Camas system would have had a large amount of habitat to generate stable populations						
West Fork Cottonwood Creek	08/26/02						
	We shocked three units according to the standard fish distribution data collection protocol, but were unable to capture or observe any fish in the first three units, even while extending Unit 3 to 100m.						

YCT = Yellowstone cutthroat; BRN = brown trout; BRK = brook trout; RBT = rainbow trout; YOY = Young of the Year

Solar Pathfinder

Stream surface shade is an important parameter that controls stream heating derived from solar radiation. Near stream vegetation height, width and density combine to produce shadows that reduce solar loading. Vegetative cover also creates a thermal microclimate that generally maintains cooler air temperatures, higher relative humidity and lower wind speeds along stream corridors. Bank stability is largely a function of near stream vegetation. Specifically, channel morphology is often highly influenced by land cover type and condition by affecting floodplain and instream roughness, contributing coarse woody debris and influencing sedimentation, stream substrate composition and stream bank stability

Solar radiation has the potential to be the largest heat transfer mechanism in a stream system. Human activities can degrade near stream land cover and/or channel morphology, and in turn, decrease shade. It follows that human caused reductions in stream surface shade have the potential to cause significant increases in heat delivery to a stream system. Stream shade levels can also serve as an indicator of near stream land cover and channel morphology condition.

Shade is the amount of solar energy that is obscured or reflected by vegetation or topography above a stream. In contrast, canopy cover is the percent of the sky covered by vegetation or topography. Shade producing features will cast a shadow on the water while canopy cover may not. In order to assess the ability of riparian land cover to shield a stream from solar radiation, two basic characteristics of shade must be addressed: *shade duration* and *shade quality*. The length of time that a stream receives shade can be referred to as *shade duration*. The density of shade that affects the amount of radiation blocked by the shade producing features is referred to as *shade quality*. Effective shade is the amount of potential solar radiation not reaching the stream surface and is a function of *shade duration* and *shade quality*.

The only way to accurately take into account effective shade is to be able to measure the amount of sun blocked by objects as the sun moves across the sky each day throughout the year. The simplest way to do that is to use a solar pathfinder and make a trace of shade producing objects around a stream site on a solar time chart. A solar pathfinder is a table on a tripod holding a solar time chart in the true south direction and covered with a plastic half dome that shows the reflection of objects surrounding it. The solar time chart that is placed on the pathfinder shows the average solar path for each month of the year and amount of time the sun spends at each portion of that path. By visualizing reflected objects in the dome, a tracing is made on the chart of shade producing objects. From the tracing the amount of solar time that the sun is either exposed or blocked by the objects can be determined for each month. Solar time is expressed as a percentage of the entire solar day, thus 100% solar time is the entire length of the sun's path for any given month.

The solar pathfinder was used to measure effective shade in several locations in the Beaver-Camas Subbsin in 2004 (Figures 51-61). Tracings were taken in accordance with the method manual provided by the manufacturer (Solar Pathfinder 2002) at systematically placed sites in the stream. At each site the pathfinder was placed in the center of the stream approximately one foot above the water. The pathfinder was oriented to true south by correcting for a 17° declination. Tracings were made recording all objects providing shade including deciduous vegetation and topographic features. Data from the sites were averaged to provide average estimates of solar time exposed and solar time blocked for each month from there, annual and summer effective shade averages were tabulated for specific groups of sites were stream conditions were homogeneous. Table 27 provides a listing of the percent annual and summer (April – September) effective shade for groups of stream sites in watershed. Refer to Appendix H for a more detailed description on solar pathfinder methodology.

Table 27. Percent annual and summer effective shade for stream sites in the Beaver-Camas Subbasin

Creek and Site Numbers	Ave Annual Shade (%)	Ave Annual Open (%)	Ave Summer Shade (%)	Ave Summer Open (%)
Beaver Creek (B1-B3)	64	36	48	52
Beaver Creek (B4-B8)	46	54	24	76
Beaver Creek (B9-B16)	44	56	18	82
Beaver Creek (B17-B25)	24	77	7	93
Beaver Creek (B26-B33)	24	76	11	89
Beaver Creek (B34-B38)	13	88	7	93
Camas Creek (C1-C8)	9	91	3	97
Camas Creek (C9-C13)	4	96	5	96
Camas Creek (C14-C23)	11	89	7	96
Dairy Creek (D1-D5)	64	36	47	53
Miners Creek (MC1-MC5)	61	39	46	54
Modoc Creek (M1-M5)	48	52	41	59
Threemile Creek (T1-T5)	62	38	57	44
Stoddard Creek (S1-S10)	53	47	46	54

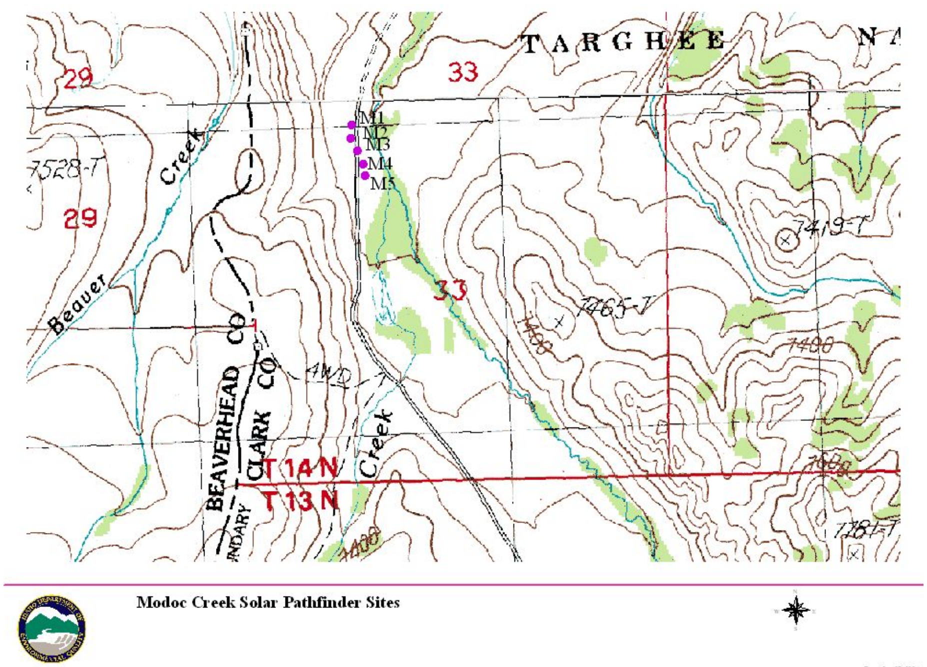

Figure 51. Modoc Creek Solar Pathfinder Sites.

Status of Beneficial Uses

The data presented in this section confirms that the beneficial uses for salmonid spawning (SS) and cold water aquatic life (CWAL) for one of the listed stream segments in the Beaver-Camas Subbasin are not fully supported. The upper section of Camas Creek and one-quarter (approximate) of the section of Beaver Creek between Spencer and Dubois, are the only two listed stretches of water that have the capacity to support beneficial uses. The data presented show that the part of the listed section of Beaver Creek (below Spencer), Cow Creek, and the lower half of Camas Creek are not perennial streams, by both natural and anthropogenic dewatering of the channel. The maintenance of a fishery in dewatered streams is limited therefore, beneficial uses cannot be supported until flows are returned to the stream, where it is anthropogenic dewatering occurs.

Conclusions

Beaver Creek from Spencer to Dubois is listed for flow alteration, habitat alteration, nutrients, sediment, and temperature. The lower half (below I-15 exit 172) of this listed reach is naturally dewatered and does not have a reasonable potential to support beneficial uses. A TMDL will not be developed for Beaver Creek, below I-15 exit 172. Above the intermittent portion of Beaver Creek, a temperature TMDL will be developed since stream temperature data at the Spencer site show that the temperature criteria for SS and CWAL are not met. This section of Beaver Creek, listed for sediment as well, is completely confined in a basalt canyon and streambank erosion is not contributing to overall sediment loading to impair beneficial uses. Additionally, depth fine data collected above the listed reach is at the target level. Nutrient data collected in Spencer is below EPA suggested criteria and no nuisance algal growths are present that would impair beneficial use support. Therefore, a nutrient TMDL is not necessary for this particular section of Beaver Creek. Beaver Creek will be de-listed for nutrients.

Beaver Creek from Dubois to Camas Creek is listed for the same pollutants as the upper portion of Beaver Creek. As shown by the flow data presented in section 2.3, Beaver Creek below Dubois only receives flow about one week out of the year. A TMDL will not be developed for this section of Beaver Creek since it is intermittent.

The upper listed section of Camas Creek (Spring Creek to Hwy 91) is listed for flow alteration, habitat alteration, nutrients, sediment, and temperature. As with Beaver Creek there is a point (T9N, R37E, section 16/N44.19270°, W-111.98284°) in this reach where the stream is flow altered (anthropogenic and natural). From that point down a TMDL will not be developed. From that point upstream, temperature and sediment TMDLs will be developed since stream temperature data exceeds the criteria (CWAL and SS) and depth fine samples are above the 28% target and bank erosion is evident and sediment deposition in spawning habitat is impairing beneficial uses. A nutrient TMDL will not be written for this stream because water column samples are below the EPA suggested criteria and deleterious levels of macrophyte growth are not present in the stream. This section of Camas Creek will be proposed for de-listing for nutrient, sediment, temperature and re-listed as flow altered.

Cow Creek is listed with an unknown pollutant. Cow Creek is an ephemeral stream and therefore a TMDL will not be developed for Cow Creek. Cow Creek will re-listed as flow altered.

Nitrate (NO_3) + Nitrite (NO_2) Nitrogen concentrations were above the EPA suggested criteria on E. Fk. Rattlesnake Creek however, visible slime growth or other nuisance aquatic growth impairing designated beneficial uses were absent. A nutrient TMDL is not necessary for E. Fk. Rattlesnake Creek since Idaho's narrative water quality criteria for nutrients are met.

Stream temperature data was presented for several streams in the Beaver-Camas watershed. As stated above, TMDLs will be written for the listed areas of Beaver and Camas Creeks where flows are perennial. In addition to Beaver and Camas Creeks, temperature data was provided for eight additional streams; Stoddard, Miners, Dairy, Modoc, Crooked, Threemile, West Fork Rattlesnake, and East and West Camas Creeks. In four of the locations, Stoddard, Miners, Rattlesnake and Crooked Creeks the stream is flow altered (anthropogenic or natural) and flows were intermittent therefore a TMDL will not be written for those streams where there were documented exceedances.

Major temperature exceedances (>10%) were documented Dairy, Modoc, and East and West Camas Creeks (perennial). Temperature TMDLs will be written for all of these streams. In addition, stream temperature data is available for Beaver Creek above the listed reach and temperature exceedances were documented therefore, the Beaver Creek temperature TMDL will extend above the listed reach to headwaters.

2.5 Data Gaps

The hydrology of the Beaver-Camas subbasin is a complex system of naturally loosing reaches and diversions and canal systems. In many cases, existing stream conditions diverge from those of natural conditions due to land management activities such as diversions and riparian grazing. The upper sections of the watershed tend to show the most promise for beneficial use support from both a flow and stream condition perspective.

Despite hydrologic limitations, some biological and water quality data was collected in the subbasin and it was available for analysis. However, subsurface fine sediment data was limited and it is extremely important in assessing sediment impacts on salmonid spawning habitat.

Since sedimentation appears to be the largest water quality issue in the basin, streambank erosion inventories should also be conducted during the implementation phase of the TMDLs to provide for a more precise and accurate description of water quality in the Beaver-Camas drainage.